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completed work, aggregating nearly twelve hundred pages, stand as a most pleasing monument to the ability of the authors on the one hand, and on the other to the generosity of the business men of California, who voluntarily defrayed all the expenses of preparation and publication.

*F. Periodical Publications.*—The *Bulletin of the Torrey Botanical Club* and the *Botanical Gazette* continued throughout the year as our only exclusively botanical journals. Each gave good evidence of substantial growth. The botanical departments of the *American Journal of Science* and the *NATURALIST* were maintained as usual. Botanical articles frequently appeared also in the *Gardener's Monthly*, *American Agriculturist*, *American Monthly Microscopical Journal* and the *American Journal of Microscopy*.

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## EFFECTS OF REVERSION TO THE WILD STATE IN OUR DOMESTIC ANIMALS.

BY HON. J. D. CATON.

A UNIFORMITY of form, color and habit in individuals among the various species of wild animals, is almost universally observed, and the loss of this uniformity under the influence of domestication, if less universal, is very general. How long it took to produce these changes in the horse and the ox, the sheep and the goat, we cannot know, for these were subdued to domestication before events were recorded which might tell us of the struggle. That some animals were more readily influenced by domestication than others, we know. How readily the wild turkey changes in form, color and habits under the influence of domestication I have demonstrated by my own careful experiments, an account of which I gave in the *AMERICAN NATURALIST* for June, 1877. That the domesticated reindeer of Lapland have become parti-colored, while their wild brethren of the mountains all about them retain a uniform color, I have shown in "The Antelope and Deer of America," p. 330, and in "A Summer in Norway," p. 223. The deer in the parks of England and Ireland have become unstable in color, although they have been subjected to the influence of domestication for a much shorter period than have the reindeer of Lapland. These are the most striking instances among the quadrumana, which occur to me, to

enable us to compare the wild with the domesticated animals, although the wild horse and the wild ass are still met with in Asia, and the wild ox still existed in Scotland till within very recent times at least, but it may be well doubted whether the wild cattle of Scotland are the progenitors of our domestic ox. The domesticated buffalo, as seen in Southern Europe and Asia, and in Northern Africa, has degenerated less in both color and form than most other quadrupeds under domestication, and his wild habit still possesses him to a certain extent.

The wild boar submits to domestication with remarkable docility, and human care changes its form, color and habit in a very short time and in a remarkable degree. Human care, by judicious selection, may fix varieties of all these domesticated animals with persistent characteristics, but immediately his supervising care is withdrawn, all these peculiarities disappear.

Of the birds, perhaps the peacock resists the influence of domestication with the most persistence, though the guinea fowl undergoes no perceptible change from generation to generation, with rare exceptions.

While all have had opportunity to observe the changes which have been wrought in our domesticated animals by human care and supervision, opportunities have not been so general for observing the effects upon our domesticated animals when allowed to return to the wild state. My observations lead me to the conclusion that the tendency is not only to return to the wild habit, but to the original form and coloring of the remote wild ancestor. That there is some law governing this reversion we may well believe, though we may not be able to fully understand it yet.

My own observations tend to show not only a tendency, at least in some species, to revert to the original form and color of the wild ancestor, but they also suggest the possibility that this tendency is the strongest in those cases where the domesticated animal has most recently been reclaimed from the wild state, or in those cases where the change produced by domestication was the most rapid.

I have had the best opportunities for studying this subject in the Hawaiian islands. With the exception of the goose and the duck, nearly all of the animals which have been introduced into those islands since their discovery, as well as those which were then held in domestication,<sup>1</sup> have reverted to the wild state.

<sup>1</sup> They had the hog and common fowl when discovered by Cook.

Among these I may mention the ox, the horse, the goat, the sheep, the hog, the dog, the cat, the turkey, the peacock and the barnyard fowl. Where I had not the opportunity of studying these personally, I spared no pains to gather the facts from the most reliable sources.

The greatest physical degeneracy was observed in the wild horse and the wild sheep. The ox was introduced by Vancouver, less than a century since, upon the island of Kauai, from California, whence it was introduced upon the other islands. At most it has been subject to the new influences scarcely three quarters of a century. During that time no appreciable change has taken place in the coloring of the ox, nor much in his form, but his habit is wild and wary, fleeing from man in alarm; and he has acquired great fleetness over the lava beds in the mountainous regions which he selects for his home. While he is terrified at the approach of man; when wounded or hard pressed he becomes bold and aggressive, and is a dangerous enemy. In some parts of the islands they have become so numerous that the scarcity of sustenance has forced them down into the lower regions, where it is feared that they may destroy the forests upon which it is supposed much of the rain-fall depends. Indeed, on the Island of Ouahu a large district of country was pointed out to me which was said to have been once a forest, and was now entirely destitute of arboreous vegetation. This change was attributed to the wild cattle. They are hunted for their hides alone.

I saw none of the wild horses or wild sheep, neither of which are numerous. I was told that the former are much more degenerated in size, form and vigor than those on our western plains, which may be attributed to the want of an abundance of food adapted to their requirements in the elevated regions which they affect, but in habit they are as wild as the cattle.

The wild sheep, which are very limited in number, and I met with few who had seen them, were small, gaunt and long-legged, with a scant and coarse pelage.

The wild goats are very numerous, especially in the mountainous regions of the eastern islands. During the afternoon which I spent viewing the wonderful sights from the rim of the great extinct crater, Haleakala, I saw two bands of wild goats within the crater. I sat ten thousand feet above the sea. The chasm before me was seven miles across and two thousand feet deep. Its

vertical walls in a few places had been partially broken down, so that bunches of grass had taken root on the shelves or steps formed in the disintegrated lava, and the goats were clambering about, leaping from shelf to shelf, seeking food. Towards evening they descended to the floor of the crater and disappeared in its eastern arm. With the naked eye they could not be identified, although one band was directly beneath me, but a good field glass revealed them very plainly. A large majority were snow white, some were parti-colored, and one appeared to be black. Their natural capacity for climbing has no doubt been improved by their reversion to the wild state. They are very wild and cautious, and difficult of approach by the hunter. They, too, are hunted for their skins.

The most marked and rapid change is produced in the hog by his emancipation from the restraints of domestication and the care of man. In a single generation he changes in form, color and habit from the staid and quiet porker to the fleet and fierce wild boar. The latter is the character as described to me by all who had been interested to make observations on the subject, of the numerous wild hogs now roaming in those islands. Col. Chas. Judd assured me that many years before a lot of hogs escaped from his ranch on the easterly side of Ouahu and went into the mountain which bordered the ranch. Among them was an imported boar. Before he could find them they had become so wild that he could not reclaim them from their mountain fastnesses. He got sight of this boar many times during several succeeding years. He was so marked that he could readily identify him. The change in form and habit were almost immediate. He soon became wild and almost as fleet as a deer. His body became thin, his back arched and his legs *appeared* to be much longer than when he escaped. Much slower was the change of color, but this finally occurred to a very appreciable extent, so that in a few years he had distinctly assumed the dark sandy shade of the wild boar. He wisely forbore to shoot him that he might study the developments which he saw going on. In the third or fourth generation the pigs showed very distinctly the sandy shade and stripes observed on the side of the young of the wild boar. From these and similar observations, I should infer that it would not take very many generations, with proper care, to completely domesticate the wild boar.

I heard of but two places where the pea fowl had gone wild. The first was at the plantation of Col. Judd, before mentioned, and the other was the plantation of Capt. McKee, on the Island of Maui, whence the birds had escaped and gone into the mountain above. No change was observed except that they had become wild, but not excessively so, and I did not learn that they had been much hunted in either case.

At what time the domestic turkey was first taken to the islands, I did not learn, but probably not very long after their discovery, or certainly soon after the arrival of the first missionary, which occurred in 1820. We may safely assume that soon after, some of them wandered away and reverted to the wild state, and now they are found, more or less abundant, in the forest regions of most of the islands. They have not yet become as wary and difficult of approach as are the wild turkeys here. The natives trap them with some success. At Haiku I found two hens in confinement which Mr. Dickey had purchased from a native who had caught them. I studied them with great interest. They were in a large poultry house, the front of which was closed with slats. On approaching them they showed about as much alarm as our wild turkey would, similarly situated. A very decided tendency was shown to revert to the color of our wild turkey. The legs had already assumed a lightish color with a pink shade, though not so brilliant as in the wild ancestor, but quite unlike the black leg of the black tame turkey. The color of the plumage had also undergone a marked change. The ends of the tail feathers and of the tail coverts had assumed a tawny or russet shade, hardly so pronounced as in our wild turkey, but a great departure from all tame turkeys. My observations in domesticating the wild turkey show that they first degenerate in their coloring in these two points. The white bars on the wing feathers were there, but they are not always absent on the domesticated turkey.

In form, too, a change was manifest; the legs were longer and the body was longer and more erect than in the tame bird. Altogether the tendency to revert to the form, coloring and habit of their wild ancestors was very marked. I say their wild ancestors, for I think I showed satisfactorily, in a paper published in this journal for June, 1877, that the domestic turkey of this country is descended from our wild turkey.

I heard of the barnyard fowl which had gone wild in several

parts of the island, but I did not see any of them. I obtained the most satisfactory account from Mr. Emerson, a son of one of the early missionaries who was located at the north-west end of the Island of Ouahu, where the son still resides. The domestic birds escaped from his father's place at least fifty years ago, and occupy an extensive elevated or mountainous wooded country. They still nest on the ground, and are quite numerous, in spite of the depredations of the wild cats. Although he has often seen them they are the most wild and wary of any animal he had ever attempted to approach, and he was very rarely able to shoot one. At the approach of day the whole forest would be vocal with the crowing of the cock, and although secreted right among them, when daylight came not one could be seen, and all was as still as if nothing had ever disturbed the quiet of the wilderness. How they managed to disappear so quietly in the gray of the morning he could not explain, for he never heard them fly from their perches in the trees.

They had diminished appreciably in size, and had assumed a uniform buff color. Now I confess that I do not know the color of the wild bird from which our barnyard fowl, or that which was common in the States sixty years ago, is descended, but if, as I have ventured to suggest, there is a tendency, when domesticated animals revert to the wild state, to return, not only to the wild habit but to take on other peculiarities of their wild ancestors, from which they had departed under the influence of domestication, then we may infer that the original wild stock was of a buff color.

I do not know that this subject has been deemed worthy of observation by naturalists, at least I have not been so fortunate as to meet with any discussion of it, but I hope an amateur may be allowed to so far depart from precedent as to make observations in out-of-the-way directions. It may be that my inclinations have too much of a practical tendency for strictly scientific studies. I study the bones but little, for practical utilitarian features interest me more.